

# Morphometric Analysis of Lingula Sphenoidalis and Its Surgical Relevance

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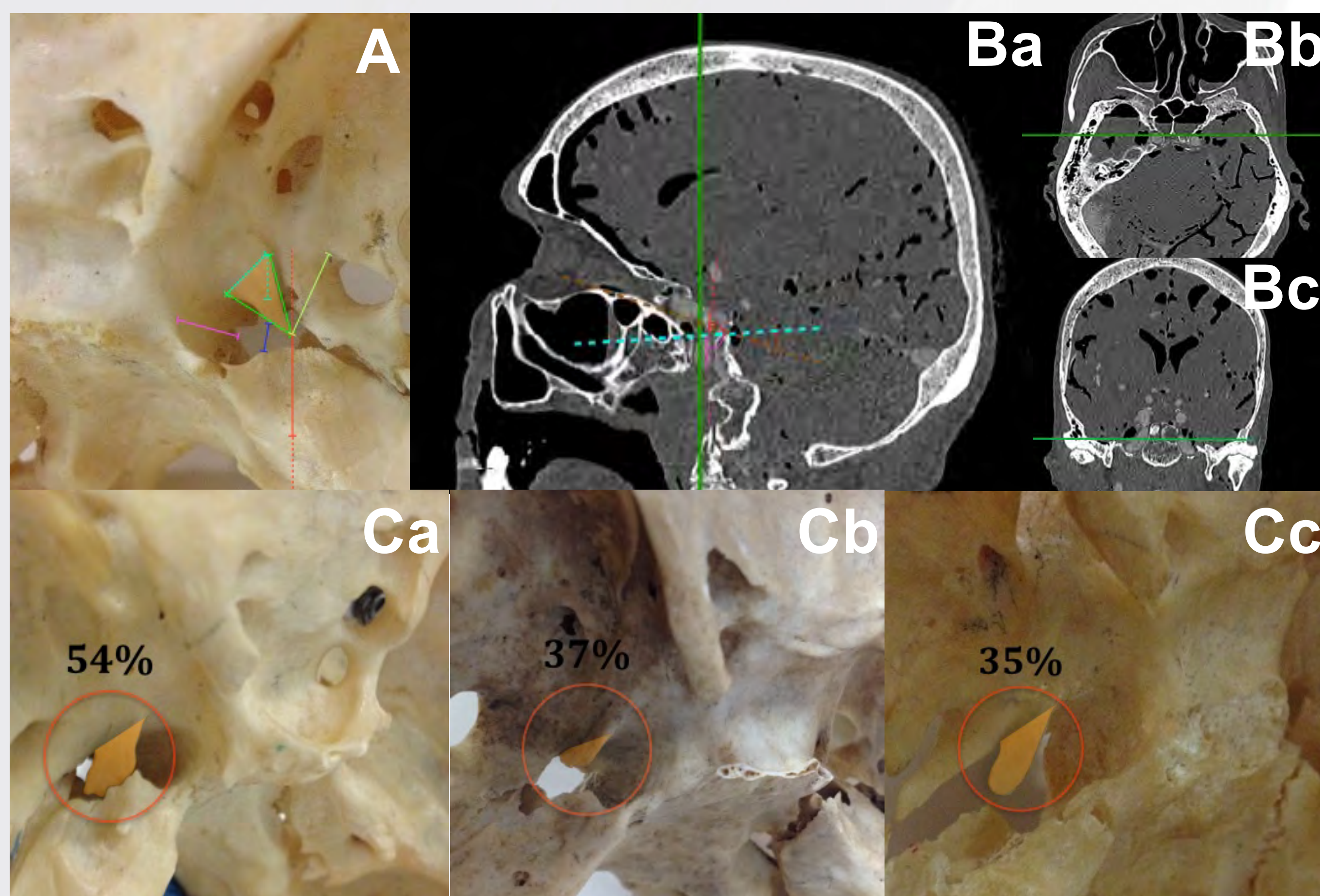
## Background

The lingula sphenoidalis (LS) and petrolingual ligament (PLL) are relevant anatomical landmarks when approaching lesions involving the posterior cavernous sinus, Meckel's cave, and carotid canal. The PLL is intimately related to these structures; running on the upper border of the carotid canal, between the LS and anterior process of the petrosal bone, it represents the postero-inferior attachment of the lateral wall of the cavernous sinus. Given the considerable variability in size and configuration of the LS, we sought to define its morphometric patterns and surgical relevance.

## Materials & Methods

In 63 dry human skulls (126 sides), the region of the LS was examined independently by 2 investigators who measured each side with calipers and ruler; data were analyzed (mean  $\pm$  standard deviation). In 5 cadaveric formalin-fixed heads bilaterally dissected through a CT-guided extradural subtemporal approach, length and width of the PLL on the internal carotid artery (ICA) was measured after anterior reflection of Meckel's cave. The angle between the petrolingual line and ICA was measured using BrainLab (Figure).

**Figure. Morphometric analysis.** **A: Measurements** of upper border LS-APP (blue); sides of LS (green); height and width of the base of LS (light blue); depth of carotid canal (purple); distance LS-TI (yellow); distance LS-FO (red) **B: Angles**, a = between the petrolingual line (broken light blue line) and Frankfurt line (broken brown line); angle between cavernous ICA (red line) and petrolingual line; angle between lacerum ICA (purple line) and petrolingual line; b = axial plane of LS; c = coronal plane of LS. **C: Shapes of LS:** a = crest; b = semilunar; c = lamellar.



## Results

- Interrater agreement ranged as follows: **good to excellent** for petrolingual line, orientation relative to Frankfurt line, width, and length of LS sides; **moderate** for height of base (Table).
- The most common shape of the LS was crest-type, followed by semilunar and lamellar-types.
- The PLL was present in all specimens (10 sides); length averaged  $11.00 \pm 1.33$  mm and width averaged  $4.70 \pm 0.82$ . When looking at the petrolingual line related to the Frankfurt line, various angulations of the ICA were identified.

## Conclusions

### DIVERSITY OF THE LINGULA SPHENOIDALIS.

Our analysis confirms the diversity of the lingula sphenoidalis, with its varied lengths and shapes. Angulations of the ICA (C3-C4) were influenced by the orientation of the petrolingual line to the Frankfurt line. Anatomical variations of the LS and PLL are significant in surgical planning, especially when using PLL as a surgical landmark to identify the ICA and cavernous sinus.

**Table. Interrater agreement** for individual data by weighted Cohen's kappa (kw  $\leq$  0.40 = poor; 0.41-0.60 = moderate; 0.61-0.80 = good;  $>$  0.8 = excellent) using SPSS software version 23.0.

| Measurements                | Rater 1                                      | Rater 2              | IRR             |
|-----------------------------|--|----------------------|-----------------|
| <i>Lingula sphenoidalis</i> |  |                      |                 |
| Upper border LS-APP         | 3.43   | 2.91                 | 0.87            |
| Longest side                | 5.76   | 5.82                 | 0.71            |
| Shortest side               | 1.71   | 1.85                 | 0.83            |
| Other sides                 | 1.71   | 1.66                 | 0.80            |
| Height base                 | 0.08   | 0.00                 | 0.98            |
| Width base                  | 2.01   | 4.80                 | 0.43            |
| Presence                    | 0.67   | 0.71                 | 0.75            |
| Fusion rate                 | 123  | 126                  | 0.98            |
|                             | 8%   | 5%                   | 0.97            |
| Depth carotid canal         |  | 9.07 $\pm$ 2.01      |                 |
| Distance LS-TI              |  | 11.67 $\pm$ 2.04     |                 |
| Distance LS-FO              |  | 9.23 $\pm$ 1.89      |                 |
| Angulations ICA-PLL         | Open dorsally<br>49% (0-30°)<br>22% (30-45°) | Open ventrally<br>2% | Parallel<br>27% |